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A Lecture

ON

OBESITY AND CERTAIN CHANGES OF METABOLISM

Delivered at the Medical Graduates' College and Polyclinic on October 27th, 1910

BY

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PHYSICIAN AT HOMBURG.

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Reprinted from THE LANCET, December 31, 1910

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A Lecture

ON

OBESITY AND CERTAIN CHANGES OF METABOLISM.

Gentlemen,—The last time I had the honour of lecturing to you my subject was on the recent advances of diabetes and glycosuria. To-day I have chosen as a subject "Obesity and Certain Changes of Metabolism," which is in many ways connected with the above-named disease. Having carried out last winter with Professor Moritz, at the hospitals in Strassburg, some scientific research work on the fluid contained in fat cells, I am glad to attempt to throw some new light on the etiology of obesity.

Obesity and glycosuria are kindred diseases; about 50 per cent. of all obese persons suffer from glycosuria, though this seems to have little prognostic value. With glycosuria heredity is an important factor in its etiology; sometimes we find that diabetes and obesity are combined with a neurasthenic disposition. A neurasthenic person may be obese, or an obese person may be neurasthenic; it is not always necessary that a neurotic be thin, though in the majority of cases obese persons are not neurasthenic. A good amount of weight may tend to the well-being of a person, but corpulency is not a sign of good health. Obese persons die young, a fact well known to the insurance companies, and they do not recover well from the effects of surgical operations. The disease of obesity itself produces during lifetime cardiac troubles and arterio-sclerosis, also physical and mental inactivity.

The very fact that fat people do not move about much tends to increase their weight; every pound they gain is a vicious circle. For instance, if a person puts on only 7 grammes per day she gains 200 grammes per month or 6 pounds a year, but the next year she will gain more than those 6 pounds, and the increase will be more than an arithmetical progression.

The primary cause of obesity lies in a misproportion between the energy taken in the food and the amount expended by the body. The remainder of the food, not burnt up and lost as heat and work, is stored up as fat. It is Oertel's merit to have pointed out to the profession how much benefit cardiac cases receive by a reduction of weight. In some cases the patients have entirely recovered from asthmatic troubles and emphysema; even cases of locomotor ataxia and kyphoscoliosis are reported by von Noorden to have markedly improved after reduction of weight.

The difference formerly made between anæmic and plethoric obesity has been given up; the distinction now made is whether the case is a case of endogenous or exogenous metabolism. As endogenous have to be considered all cases in which combustion is abnormally low, when dieting has no effect, and thyroid extract as a stimulant for the oxidising process has to be resorted to.

From the chemical structure of the fat cell we can understand that the oxidising process is a slow one. Here is the formula of tri-stearin :—

$$C_3H_5(C_{18}H_{35}O_2)_3,$$

one of the chemical compounds of the fat molecule. As the carbon molecules are high, the oxygen molecules low, it must take time until it is burned into carbon dioxide and water; carbohydrates, as we know, and proteins contain more oxygen and less carbon, therefore burn more easily. This explains why the caloric value of fat is 9, of albumin only 4. What becomes of the fat molecules absorbed? The fat is digested by the pancreatic juice, then changed into glycerine and fatty acids, which after emulsification of the fat are brought by the hepatic veins to the liver. Part of it is transformed into a carbohydrate by a synthetic process which we do not yet know; part of it is absorbed by the blood and tissues and stored up in the organism. The panniculus adiposus of the skin, especially of the abdomen, is a favourite deposit for the fat—the kidneys and the heart, too. There are parts of the organism where no fat deposit ever is found—the scrotum, labia, &c.

TREATMENT.

The treatment of obesity means underfeeding a patient on dietetic principles. Of the various methods I need only to point out to you the Banting, Weir-Mitchell, Oertels, von Noorden, and Karell's cures. Their difference lies in the amount of food to be given to the obese.

Methods.	Proteids. Grammes.	Carbohydrates. Grammes.	Fat. Grammes.	
Banting	172	87	8	= 1100 Cal.
Oertel	156	75	25	= 1180 ,,
Ebstein	102	47	85	= 1300 ,,
Von Noorden	120	35	118	= 1300 ,,

In the Banting cure the amount of fat is unusually low—only 8 grammes—whereas with Ebstein and von Noorden it is very much higher, but the amount of carbohydrates is low in proportion—about 35 grammes. The Banting cure means a severe cure, and the amount of 1100 calories is small, whereas Ebstein's diet answers more to the taste of the patient, who does not like to feel he is hungry.

Von Noorden's diet is still richer, and the only amount of food to be severely reduced are the carbohydrates. It answers very well if the patient be under the strict dieting of a medical man—i.e., in a sanatorium or private nursing home, where the proper amount of food may be weighed and nitrogenous substances of the urine examined in a laboratory; but this means for the patient great expense both in time and money, and the practitioner, unless he be a specialist on the subject, will often find it difficult to know and remember the exact caloric value of every food. But it is to the persons of limited means we have to devote our attention, and for them I think Karell's cure is preferable, for with it a patient may be treated at his own home.

Karell's cure is very useful in cases of cardiac trouble, Bright's disease, especially when combined with gout, when a diet containing no salt is advisable and œdema exists, for milk has a diuretic effect. Karell's cure is a milk diet, the essentials of which are that 2000 cubic centimetres of milk are given to a person who has a metabolism of about 3000 calories. In Karell's cure, in order to avoid too great a combustion of proteins, carbohydrates—viz., potatoes—have to be given occasionally, for proteins do not burn as rapidly when they are "protected" by a carbohydrate food. May I give you here in tabulated form a case treated by Karell's cure ?

Case of a Female Patient, 44 years of age and 165 Centimetres in Height.

Date.	Weight (kgms.).	Milk (c.cm.).	Calories.	Days.	Loss of weight (kgms.).	Per day (kgms.).
9/1	94·5	2000	1300	3	2·1	0·7
12/1	92·4	2000	1300	11	0·8	0·07
23/1	91·6	1800	1170	1	0·4	0·1
27/1	91·2	1750	1140	3	0·3	0·1
27/1	90·9	1500	925	11	1·9	0·17
7/2	89·0	1200	872	1	0·3	0·3
8/2	88·7	1500	975	13	3·5	0·13
21/2	85·2	—	—			—
				43	9·3	

Karell's milk cure has recently been re-introduced into therapeutics by Jacob and Moritz. Through this milk diet a great quantity of liquid is evacuated from the organism of the human body ; a basis is thus formed on which further reduction in weight is more easily obtained by subsequent cures. The quantity of milk to be given depends on the weight of the patient ; as an instance, we may reckon that a woman of 150 centimetres would have a weight of 50 kilogrammes ; the quantity of the milk to be given would thus be reckoned by multiplying the centimetres above 100 by 25 = 1250 cubic centimetres. If there is a loss of 50 grammes of nitrogen during the cure, this means 310 grammes albumin, or 2920 grammes meat. If we have a loss of 10,000 grammes during reduction, we have to deduct 2920 grammes of meat, but the 7080 remaining are not pure fat, but fat mixed with water. This explains why patients gain their normal weight after the cure is over—for there remains a great amount of water in the tissues and retention of sodium chloride in the body.

We have to discover what amount of water is contained in the fatty substances. There have been previous investigations of this subject, but with very unsatisfactory results. I have therefore undertaken to examine the fat in post-mortem cases as well as with patients immediately following an operation, for instance, extirpation of the mammæ. I examined 21 post-mortem cases and two cases following operations at the Pathological Institute of the Strassburg Hospital. My procedure was to take 5 grammes of fat instantly after dissection, which was then weighed on a chemical scale and placed in an incubator at a temperature of 110° C. for 48 hours; it was then transferred into an exsiccator for 24 hours, and then weighed again. The loss indicated the percentage of water in the specimen.

Case.	Sex.	Years of age.	Cause of death.	Percentages of water.			
				Fat layers of abdomen.	Heart.	Kidneys.	Femur.
1	F.	45	Cancer of intestines.	6·0	—	10·2	—
2	M.	41	Erysipelas.	7·88	—	—	—
3	F.	51	Endocarditis.	7·88	—	—	—
4	M.	69	Hæmorrhage of the brain.	9·02	—	6·86	—
5	F.	42	Placenta prævia.	10·9	—	—	—
6	F.	20	Intoxication through carbon monoxide.	10·03	—	—	—
7	M.	45	Cirrhosis of liver.	12·64	—	10·06	—
8	F.	59	Incarcerated hernia.	—	—	—	8·5
9	F.	51	Cancer of uterus. Metastasis.	12·2 19·4	—	—	—
10	F.	63	Lipomatosis of the heart.	13·45	14·27	17·94	—
11	F.	48	Cancer of the nose.	13·0	21·7	—	19·9
12	F.	22	Pneumonia.	17·03	—	—	—
13	F.	22	Uræmia.	—	—	—	16·7

Case.	Sex.	Years of age.	Cause of death.	Percentages of water.			
				Fat layers of abdomen.	Heart.	Liver and kidneys.	Mamma.
14	F.	25	Septicæmia.	—	—	20·06	—
15	M.	48	Tumour of the brain.	20·2	—	19·8	—
Cachectics and Underfed.							
16	F.	73	Pneumonia.	—	—	22·32	—
17	M.	60	Cancer of the œsophagus.	—	—	28·5	—
18	F.	84	Apoplexia.	—	29·42	—	—
19	F.	79	Pneumonia.	—	35·84	46·24	—
20	F.	61	Pneumonia.	36·41	—	—	—
21	F.	58	Cancer of the stomach.	36·43	—	—	—
After Operation.							
22	F.	50	—	—	—	—	13·3
23	F.	52	—	—	—	—	22·2

The results of my experiments tend to show 13 per cent. of liquid substance in the fat cells, but there is a slight difference if the fat is taken from the heart, the abdomen, or the kidneys. With the fat of the heart there seems to be a slight increase of the water. May I call your attention to Case 9. Between the amount of water in the fat cells close to the metastasis of a carcinoma and the fat at some distance was a difference of 7·2—in the first 12·2 and the second 19·4. In carcinomatous patients there are an increase of the liquid substances in the organism and formation of an œdema against the toxins produced. Voit stated that 30 per cent., Volkmann estimates 15 per cent., of water is contained in the fat cells ; thus my experiments would verify Volkmann's calculation. You will find a difference between persons who are ill-nourished or cachectic and well-nourished. The amount of the water contained in the fat cells was about 7 to 14 per cent. (see Cases 2 to 9), though the fat layer measures sometimes almost an inch, but with the cachectic the amount of the water was higher (see Cases 16 to 21).

With the two specimens taken from persons immediately following operations (extirpation mammæ due to tumour) the amount of water was 13 and 22 per cent. Please notice that persons in whom a high percentage of water was found were old. A fact proved by Ranke was that the organs contain more liquid in old age, and therefore the fat cells naturally become charged with water as well.

With cachectics the tissues become impregnated with a kind of gelatinous substance, especially the fat cells. We can understand this as it is quite natural that in a person suffering from a malignant disease the reserves of fat are consumed by the disease and the fat cells replaced by an albuminous liquid.

Becquerel, Rodier, and von Hosslin had similar results with the blood and tissue of carcinomatous and tuberculous cases, where there was an abnormal increase of the liquid substance.

The low amount of water contained in fat cells gives us an explanation why it is practically of no difference whether the amount of liquids be reduced in the diet—with 13 per cent. of water contained in fat cells it is of no importance whether liquids are given or not—the fat cells do not take more fluid—and would not be influenced by a reduction of liquid given.

Now, if we reckon a 13 per cent. amount of water in fat and take this into consideration in the balance of calometric equilibrium we would have the following results. During a period of 48 days a patient lost 50 grammes nitrogen, which corresponds to 310 grammes albumin, or 2920 grammes flesh. The loss of weight during these days was 12,000 grammes; deduct for flesh 2920 grammes, and there remain 9080 grammes, of which, with a 13 per cent. amount of water in fat, 639 grammes are water; thus 8441 grammes of pure fat have been lost, or 175 grammes a day. 175 grammes a day of fat give 1627 calories; thus if we put 1627 calories lost through weight in our calculations we have 1300 calories of the milk, 1627 calories lost, making 2927 calories, about the daily amount of calories necessary for one person.

As I said before, Karell's cure, which has lately become very popular on the continent, may form the basis for a further cure on Weir Mitchell's, Ebstein's, or von Noorden's principles. I need not point out to you that Weir Mitchell's treatment is a cure in which milk and proteid food is combined, during which milk and eggs are given, half a pint of milk and an egg every three hours, five or six times within 24 hours ; but it may be more to the advantage of the patient to feed him on a richer diet, for the patient may soon get tired of underfeeding himself on a very strict line, and then give up the cure entirely, and therefore Ebstein's diet is advisable. As the French say, "l'appetit vient en mangeant." The diet should consist principally of meat, avoiding pork, goose, duck, and fat smoked beef ; fish is allowed except salmon, lobster, sprats, herrings ; toasted bread or rusks are preferable to fresh bread ; no cake or biscuits. As to vegetables—potatoes, carrots, turnips, beans or peas are not allowed. Vegetables should not be cooked with butter or oil. Not allowed compôtes, dried fruit ; no cheese. No soups, chocolates, cocoa, brandy, whisky, or champagne.

A drawback of all cures to reduce weight is that constipation soon takes place, due to the scarcity of food given, and as about 15 per cent. of the dried substances of the fæces consist of neutral fatty acids non-absorbed they cause a peristaltic movement and their elimination causes constipation. Remedies for constipation have to be given during the cure.

During a cure all alcoholic drinks ought to be reduced. The theory of reducing the liquid is antiquated, and plenty of ordinary water or mineral water may be allowed. It is Yorke Davies's merit to have pointed out that a reduction of fluid was not advisable at a time when Oertel insisted on great reduction of all fluid.

A great help in the treatment of obesity is a cure in a health resort, for there a dietetic cure may be taken under better control than at home, and drinking the waters, combined with plenty of exercise, massage, and Turkish baths, reduce the obese quickly. Harrogate in England, Brides-les-Bains in France, Homburg, Carlsbad, and Marienbad on the Continent, are some of the favourite resorts sought by the obese. Patients are very apt to take too much of these waters in order to get thin soon. In my practice in Homburg I knew an American lady to take seven glasses of the Homburg waters in order to get thin fast. Needless to say, she collapsed after a week and was severely ill for some time.

The effect of taking the waters at spas like Homburg or Marienbad would be an ephemeral one unless the patients were taught how to diet themselves afterwards. In Homburg great attention is given to dieting; every hotel keeper and proprietor of a lodging-house is supplied with the necessary forms of diets, and special cooking is arranged. Some devote themselves exclusively to this dietetic task, and diabetes or gout is treated on the same dietetic line. The advantage of the Homburg waters is that they are purgative, a valuable item in the diet of the obese, who are apt to suffer from constipation, the Elisabethen spring containing 9 per 1000 of chloride of sodium, the Landgrafen Brunnen about 11 to 1000. I need not speak of their effect, for their laxative effect in colitis, the increase of hydrochloric acid in cases of anacidity of the gastric juice, is well known. Combined with these waters, the climbing of the hills, the carbonic acid baths, and the mud applications are beneficial in this cure. Homburg, being situated at an altitude of 800 feet, is especially beneficial by its bracing air to the cases of anæmic obesity, the amount of hæmoglobin increasing at a considerable altitude.

Should a dietetic cure not lead to satisfactory results treatment with thyroid is indicated, but in many cases thyroid is advised when the diet alone would have helped the patient, if carried on for a certain length of time. For there are cases in which the retarded metabolism of obesity does not seem to yield to a dietetic treatment, and patients, though undergoing a course of diet for a length of time, say that they are fed with only 900 calories, do not lose weight. These cases are due to a constitutional tendency, and they are cases to be treated with thyroid. The reduction of weight soon takes place and they remain less obese. During this treatment we have to watch the action of the heart and the pressure of blood; should the pulse increase, it would be advisable to discontinue this treatment. The amount of thyroid to be given, as a rule, is three grains, three times a day during the meals for a couple of weeks. No thyroid ought to be given in the climacteric age.

I may mention that there are relations between corpulency and secretions of the hypophysis gland. The extract of the hypophysis, the pituitary extract, is able to reduce corpulency as well as the thyroid extract. These facts show a relation between obesity and internal secretion of these glands.

In former days much importance was given to sexual obesity; the extirpation of the testes seemed to produce corpulency—the eunuchs of the Turkish harem were always quoted. Yet even complete withdrawal of the ovaries or testes may have no effect on the metabolic process. I refer here to an experiment of Luthje, who examined during one year the carbon and mineral metabolism of castrated and normal dogs, and determined the total composition of the bodies. No difference whatever could be found between the normal and pathological animals.

There exists one form of obesity, called adiposis dolorosa, or Dercum's disease, when adipose tumours form and pains occur. This kind of obesity causes atrophy of the muscles and debility of the nervous system. It is not very frequent on the continent.

Von Noorden, in Vienna, says that these cases of retarded metabolism, or "endogenous obesity," as he calls them, are about 20 per cent. among the Jews and 5 per cent. among the Caucasian races; and as obesity is very frequent among the Jewish race he attributes it to their tendency to marry in their own race.

It may look easy to reduce weight by underfeeding, but it is very difficult for the patient to maintain this reduced weight without suffering from general weakness. However great the number of patent medicines used by the public may be, none answers so well as carefully dieting a patient. We know too well that the lines of diet are the only ones to be followed in reducing obesity, and it is our duty to educate the public to this standard.

Gentlemen, I do not propose to put before you any dietary "cure" which a specialist has established, for common sense is the line upon which the diet has to be carried out. Every case has to be individually treated and the diet very carefully watched. It is therefore of importance that the carrying out of the diet be observed by the medical man, and not left to the will of the patient. A good surgeon knows when not to operate, a good physician knows when reduction of weight is no longer necessary, for the patient too often wishes to be reduced in weight in a very short time—a mistake that might soon be followed by general weakness due to muscular debility of the heart.